

AD-769 896

A MICROFICHE SYSTEM FOR SMALL USERS

DEFENSE DOCUMENTATION CENTER

1973

Distributed By:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE

AD 769896

AGARD

ADVISORY GROUP FOR AEROSPACE RESEARCH & DEVELOPMENT

7 RUE ANCELLE 92200 NEUILLY SUR SEINE, FRANCE

Paper Reprinted from
Conference Preprint No.136
on

NEW DEVELOPMENTS IN STORAGE,
RETRIEVAL AND DISSEMINATION
OF AEROSPACE INFORMATION

U.D. C.R.
RECEIVED
NOV 28 1973
RECEIVED

NORTH ATLANTIC TREATY ORGANIZATION



Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited

A MICROFICHE SYSTEM FOR SMALL USERS

by

HUBERT E. SAUTER
Deputy Administrator
Defense Documentation Center
Cameron Station
Alexandria, Virginia 22314

SUMMARY

In the design of microfiche systems, the "small user" often gets lost amongst the larger needs of the libraries and information centers. He frequently is an individual working at his desk or bench, not as an adjunct of a library. This paper attempts to examine the small user and two aspects of the environment in which he works: a multiplicity of microfiche forms of varying quality and serviceability and reader equipment of often dubious utility. Acceptance by the user of microfiche as a medium within which he can work efficiently is seen as a critical need. To improve the degree of acceptance, this paper takes a look at what is on the market now and what appears to be forthcoming in the near future that will make the small user a better user of a medium that is here to stay.

1. INTRODUCTION

The use of microfiche by scientific and technical governmental agencies has become a well established practice during the past decade; in addition, there is a proliferation of its use by educational, business and social institutions, and individuals. While once considered "a necessary evil or evil necessity," microfiche as an information carrier is fast becoming acceptable and often indispensable. Early predictions of its almost universal use now appear more than idle prognostication. Nevertheless, there are still many problems. It is the purpose of this paper to consider these problems and to provide background information for those interested in working toward solutions.

A. What is a "Small User"?

"Microfiche Systems for the Small User" is the title of an article by Alan W. Wilber.² It appeared in the January 1972 issue of the *Journal of Micrographics* and was basically a condensation of the findings and conclusions of a study performed by Systems Development Corporation (SDC) for the Defense Documentation Center (DDC).

One of the first objectives of the study was to define the small user. Fifty active military users were selected for a survey sample. On the basis of the number of technical reports on microfiche ordered during Fiscal Year 1969, forty-one of the users were categorized as "small," since they ordered between 200 and 1000 documents per year, as contrasted with 2,000 or more for "large" users. Additional data obtained by personal interviews and the circulation of a questionnaire showed, however, that the number of reports ordered annually had little relationship to actual microfiche operations. In some cases, one-man operations ordered and maintained larger collections than technical libraries. Also, some of the more substantial microfiche collections had derived from sources other than the defense community. For example, one of the smallest users, on the basis of the initial criteria, was receiving Department of Defense (DoD) microfiche at the rate of about 300 per year, but his overall collection was increasing at the rate of about 5000 microfiche per year with input from other sources.

The small users were categorized as follows:

	NUMBER	PERCENT
Technical Libraries and Information Centers	22	54
Individual Users	11	27
Order Desks	8	19
TOTAL	41	100

In establishing the above categories some approximations were necessary because functions often overlap. For example, technical libraries generally order microfiche for individual users. The categories, however, quite accurately distinguished the different users surveyed and their functions. These were more specifically defined: as "order desks," if they maintained no collections; as "individual users," if they kept collections for their own use or for persons working with them on the same project, and as "information centers," if they maintained the collections and existed primarily as support and service activities for users.

It should be emphasized that this survey of the small-user population was based on a sampling of DDC/DoD users to determine requirements and provide a basis for the design of microfiche storage and automatic retrieval equipment for the small-user group.

Further, the SDC study was confined to technical reports, scientific and technical journal articles, and similar documentary items distributed in microfiche form. The task of defining small users

on the basis of annual microfiche input becomes more difficult and unrealistic when microform holdings from agencies other than DoD, and similar report-oriented organizations, are considered. In the ultimate sense, the small user is not a library or an order desk but an actual individual (or small group of individuals working on a related project and sharing the same reading equipment and microfiche source material). It is in this sense that "small user" will be used throughout the balance of this paper. "The real future of microform usefulness may not rest on large library utilization and not on use of computer output but in its acceptance and utilization by individuals."⁴

B. The Microfiche System

Modern usage of the word system denotes a bringing together or combining of all elements needed to accomplish a specified task. In the broad sense, it implies the total picture. Thus, a microfiche system includes all elements needed to photograph a series of documents, develop the resulting film, view it, store it, retrieve it, reproduce from it, and make it available to others. If any elements are missing, then the system is incomplete.

In a restricted sense, the word system can be applied to any part of an operation. In the article, "Microfiche Systems for the Small User," system refers only to a means of retrieving microfiche when quantities stored grow beyond the "shoe box" size.

For many microfiche users, particularly the small ones and those using technical report material, a system consists of two main parts: microfiche and a reader. In this case, it simply means that someone else had to supply the missing elements of the total system; e.g., microfiche of technical report material is usually prepared by a major documentation center.

It is obvious that no one total system can be recommended for the total "small user" community; therefore, for the purpose of this paper the emphasis will be on only two main parts: microfiche and means to view them.

C. Microfiche

The term fiche is of French origin and refers to a variety of devices, the most descriptive, for our purpose, being a card or slip (such as used for taking notes). Without limiting the term, fiche could include any flat form, such as a file card or a slip of paper, an opaque or a transparency.

When applied to microcopying, however, the term has come to mean a transparency in flat form to distinguish it from another large group of information carriers known as micro-opaques. These two classes--micro-transparencies (fiche and roll) and micro-opaques--are basics which include all of the present forms on which microcopies are made.

There is another distinction--the term microfiche has not been encumbered with a multitude of trade names, whereas the opposite is true with micro-opaques. Names such as Microcard, Microprint, Microstrip, Microtape and Microlex have definite proprietary size and process connotations.

Microcopying (and reprographic) terms are slow to appear in modern dictionaries. For this reason, glossaries like the National Microfilm Association's Standard Glossary of Micrographics⁵ and the "Glossary" section of the American Library Association's Copying Methods Manual⁶ are important aids to communications. The NMA publication provides the following definitions:

(1) microfiche

A sheet of microfilm containing multiple microimages in a grid pattern. It usually contains a title which can be read without magnification.

(2) microform

A generic term for any form, either film or paper, which contains microimages.

(3) microimage

A unit of information, such as a page of text or a drawing, too small to be read without magnification.

Microfiche, in the pattern we know today, we've used in Europe for about a quarter of a century before moving to America. Credit for the first modern use of microfilm in flat forms (microfiche) properly belongs to the pioneer microfilers using their Leica cameras. They found the small 35mm strips of roll film very difficult to handle and to store. Accordingly, the rolls were cut into short strips and inserted into envelopes or transparent jackets so that the films could be stored with other notes in their respective project folders or files. Five-by-eight inch note card size was particularly popular with writers, historians and research workers.⁷ When the National Aeronautics and Space Administration (NASA) initially began microfiche production, it followed the 5 X 8 inch precedent. However, it was soon abandoned in favor of the 105 X 148mm (4 X 6") size, which has now been adopted as the international standard. The 75 X 125mm (3 X 5") catalog card size has some limited use in the United States, mainly specialized applications such as Library Resources, Inc. (Encyclopaedia Britannica) Microbook program.

Variations in image size, format and filming practices will be discussed under the section on "standardization."

2. USER ACCEPTANCE

Any system will fail if it is not reasonably acceptable to the user. Over the years the question of whether the user would accept microfiche, or any microform, has been the subject of numerous discussions and articles. The highlights of a few of these will be summarized. It should also be

pointed out that greater acceptance will be brought about by factors such as; economics--greatly increased postal rates and increased prices for "hard copy," and greater availability--increased dependence on microfiche by government agencies. In the United States this trend is obvious, and in other countries this is also becoming evident. For example, AGARD considered the use of microfiche for scientific and technical report material of the NATO Member Nations and recommended that "European Documentation Centres should produce their own reports as microfiche and encourage their customers to make full use of this material."⁸ User studies, as mentioned previously, are numerous and it will suffice to cite just the following:

A. In an article "Microforms, Microform Equipment and Microform Use in the Educational Environment,"⁹ Fritz Veit presents an excellent update of the microform art. The section on user studies is particularly applicable. Mr. Veit noted that microform can no longer be relegated to archival roles, but must become action-oriented.¹⁰ He also discussed other studies concerned with user problems as follows:

(1) Lewis, Ralph W. "User's Reaction to Microfiche--A Preliminary Study."¹¹ (Veit, p. 460). Mr. Lewis considered his study important because government agencies more and more were distributing their reports only in microfiche form. He was surprised to discover that the majority of users had a negative attitude toward fiche. He stressed that "considerable effort must be made to help scientists overcome this coolness, or at times even antipathy, toward microform use."

(2) Kottenstette, James P. "Student Reading Characteristics: Comparing Skill-Levels Demonstrated on Hard Copy and Microform Presentations," (Veit, p. 461). This study, made with the aid of a group of University of Denver students, revealed that "in the case of substantive reading materials (such as required reading) the reading ratio and comprehension level were not in any essential way affected by the kind of information carrier. The experiment included reading from ultrafiche. Even here the "information transfer by means of microform...was essentially as effective as information transfer by means of hard copy."

B. Renardel de Lavette in Microfiche Foundation Newsletter¹³ makes the following comments:

"With regard to psychological and physical objections one can mention that in America researchers have shown that there is no difference between reading printed material and reading of microfiche with help of a reader. The power of comprehension and the uptake seem to be equivalent and psychological objections do not appear to exist. The portable reader which can be held on the knee as a book to read the microfiche solves the problem such as muscle ache from reading."

Mr. de Lavette also cites the following from another report:¹⁴

"Reading Dynamics students read faster on microfilm than from books with no appreciable differences in comprehension.

"In technical biographical material there was a greater difference in comprehension between book form and microfilm. (In both cases microfilm comprehension was higher). In difficult material, comprehension showed no appreciable difference in all groups.

"Because they were able to read faster and cover all assigned material in much less time and with better comprehension, Reader Dynamics students:

- (1) were able to answer all the questions on the tests with greater comprehension,
- (2) complete the assignment without fatigue, and
- (3) were able to get the whole point of view."

C. Another report is Wooster's "Microfiche 1969--A User Study."¹⁵ Dr. Wooster was asked by the Chairman of COSATI (Committee on Scientific and Technical Information) to make an "appraisal of user acceptance of microfiche with recommendations for action, if warranted." Dr. Wooster concluded that there was "fairly rigorous counter-proof to the statement, no scientist or engineer can, or will, or should use microfiche." He also found that "cadets, midshipmen, and students accepted microfiche with far less grumbling than their elders--apparently they were never told that this was not normal procedure." The main complaints were about the poor quality of microfiche, that readers were unavailable, and difficult to use.

D. Finally, Campbell's "A Successful Microfiche Program,"¹⁶ is an excellent report showing the positive steps taken at Hughes Aircraft Company to persuade its clientele to use microfiche. An attempt is made to show that the ingredients necessary for a successful microfiche program are: education of the potential user, ready availability of equipment and a demonstration of the economical advantages of microfiche over hard copy.

3. USER TRENDS

It can be anticipated that as more low-cost high-quality personal microfiche readers become available, the need for "hard copy" will be greatly reduced. It should be emphasized that the situation will be quite different from that of the past when only a few reading machines were available, most of them table top models installed at locations some distance away from the user. This often necessitated the need for a paper "working copy." However, the centralized location concept will probably continue in the case of roll film and readers. An article by Ted Sawyer, "Hard Copy from Microfilm,"¹⁷ is of interest in examining the "working paper" concept need for hard copy. It should be noted that his comments apply primarily to roll microfilm. Few, if any, suitable personal size roll microfilm readers are available, and we can

expect that trend to continue.

Most small users with personal size readers will probably find that their need for hard copy will be less than their present need for electrostatic copying. It is no more logical for the small user to acquire a high priced reader-printer than for him to have his own machine for making an occasional electrostatic copy of a page or so. If the user needs a hard copy or printout, he can have it made at a supporting technical library, which in many cases can supply a duplicate microfiche as well.

It can be noted that, in the U.S. alone, there are about 300,000 amateur photographers, many of them with enlargers, printers and dark rooms, as well as numerous photo shops and drug stores--all capable of producing prints from microfiche negatives. There is really nothing mysterious about the process, and such silver halide techniques will, more often than not, produce better copies than the finest office copying machine.

People working with microfiche tend to overlook the fact that at the present time a significant amount of the microform material used in research libraries is on 35mm roll film. Thus, from the user's point-of-view, the need for a good reader-printer for roll film is perhaps more acute than for fiche.

The future points towards a so-called "paperless society." One doesn't need to be a prophet to see what is in store, but for those of us concerned with scientific and technical information and microfiche, we need to be prepared for it.

In line with the above forecasts, microfiche "married" to sound will certainly be available; microfiche in color is already a firm reality; microfiche for pleasure reading is also here. Three-dimensional fiche is only a matter of someone with vision putting it on the market. The technique has already been developed.

4. MICROFICHE SOURCES

Modern microfilming began with the introduction of the Leica camera in 1924. This forerunner of the multitude of 35mm cameras now on the market was initially developed as a means of testing motion picture films. Scholars, however, soon discovered the Leica and found that they could microfilm original documents in courthouses, monasteries, archives and other places in less time, with minimum effort and with considerably greater accuracy than by copying extracts by hand.¹⁸ These pioneers developed microform systems in the broadest sense, for they not only photographed the documents and processed the film but also improvised viewers for reading the results.

While seldom mentioned in the literature, there is still a small but significant group of individuals who make their own microform because of personal preference or necessity. Modern hand cameras with parallax-free single-lens reflex (SLR) viewing and improved films have made the job easier. Hawken has indicated that "hundreds of thousands of pages of archival material have been filmed by means of hand cameras by individual research workers."¹⁹ More often than not, the material is filmed to the individual's own standards and seldom used for the production and distribution of multiple copies.

The most common type of microform system for small users is often referred to in the literature as SOM or small office microfilm. Most of these systems are business-oriented operations and depend on a local laboratory for processing. Generally the microfilm output is in roll form, and then often converted to microfiche by jacketing.²⁰

By far the largest source of microfiche are the agencies of the United States Government. The following table gives a five-year comparison of the number of microfiche produced and distributed by selected agencies. The numbers are approximations:

MICROFICHE PRODUCED (TITLES)

	<u>1967</u>	<u>1972</u>
Defense Documentation Center	53,000	43,000
National Technical Information Service	3,400	15,000
National Aeronautics and Space Administration	46,000	36,000
Educational Resources Information Center	3,000	12,000
Atomic Energy Commission	10,000	13,000
TOTALS	115,400	119,000

MICROFICHE DISTRIBUTED (COPIES)

	<u>1967</u>	<u>1972</u>
Defense Documentation Center*	173,000	610,000
National Technical Information Service	675,000	1,625,000
National Aeronautics and Space Administration	4,500,000	2,750,000
Educational Resources Information Center	470,000	7,534,000
Atomic Energy Commission	2,040,000	1,630,000
TOTALS	7,858,000	14,149,000

*Classified and restricted distribution only--unclassified distribution handled by National Technical Information Service

Several points are worthy of note: (a) while the number of titles produced has increased only slightly, the number of titles distributed almost doubled, despite the fact that a number of the agencies

implemented "user charges" for microfiche during this period; (b) distribution of educational materials is greater than that for scientific and technical information. This obviously will have an impact on user acceptance.

In addition to the United States Government report activities as represented by DDC, NTIS, NASA, ERIC and AEC, microfiche publication of Government Printing Office (GPO) material is under consideration. Also much government related material is published by private concerns; for example, the Congressional Digest²¹ is now available on microfiche.

In countries other than the United States the use of microfiche appears to be taking hold at a much slower pace. As mentioned previously, AGARD in 1970 recommended that "European Documentation Centres should produce their own reports as microfiche and encourage their customers to make full use of this material." A letter survey of these centers brought ten responses; six indicated that they do not produce microfiche, one is considering plans, and three are actually producing microfiche. The United Kingdom's Defence Research Information Centre reports approximately 4,000 titles per year; the Canadian Defence Research Board, 500 titles in 1972 and estimates 1,500 in 1973, and Portugal's Direccão do Serviço de Material Força Aérea, 1,500 annual title output. Her Majesty's Stationery Office (HMSO) has also started a microfiche publishing program.²² Also, Inter Documentation Company AG of Switzerland currently has some 250,000 volumes of technical material on microforms ready for delivery at an average cost of about one U.S. cent per page. (To encourage new users, reading machines are supplied free of charge on specified orders.)²³

Going still further east, interest in microfiche is reported particularly high in Russia and Japan. The Russian VINITI (All Union Institute of Scientific and Technical Information) is said to have imported Fuji microfiche camera-processors, and The State Public Scientific-Technical Library reportedly uses microfiche for preservation and dissemination of information to their affiliated libraries at the rate of 20,000 pages per day.²⁴

Publishing in microfiche is becoming universally accepted, and hardly a week goes by without a news release of some new microfiche publishing venture. These are reported in Microform Review and other microform news media.

5. MICROFICHE QUALITY

The poor quality of microfiche was, and still is, a common complaint. Hard statistical information on the number of poor quality microfiche produced, or the number of complaints received, is almost non-existent. Therefore, the material presented will be general and heavily oriented towards DDC experience.

One of the major challenges at DDC in producing thousands of reports in microform and hard copy made from microform has been maintaining product quality. The microcamera cannot improve the quality or readability of the document it reproduces, and the approximately 40,000 reports processed into the DDC system annually run the gamut from excellent to illegible in reproducibility. While all documents accessioned into the collection are filmed, hopelessly illegible material is not distributed to customers. However, an effort is made to obtain maximum quality reproduction from even poor quality material in the interest of providing the widest possible distribution of R&D information. The best high-contrast film and development chemicals are used; the equipment is also the best that DDC can procure and the operators are highly skilled. Equipment does malfunction and operators do make errors, but most of the poor-quality reproductions sent out are the result of inferior original copy. For that reason, on occasion the hard-copy reproductions and duplicate microfiche furnished DDC customers are not of a satisfactory quality.

This situation is not as bad as it has been at times in the past. For several years the Department of Defense and the Federal Government in general have expended a concerted effort to improve the reproducible quality of R&D reports prepared by and for the Government. In 1968 the Committee on Scientific and Technical Information (COSATI) of the Federal Council for Science and Technology published its "Guidelines to Format Standards for Scientific and Technical Reports..."²⁵ and other similar standards²⁶ have followed. These instructions have educated the originators of R&D documents on the importance of clear, sharp typography, the avoidance of colors that will not photograph, and the proper makeup of line drawings, charts and tables for maximum reproducibility. For recent reports, the result has been a gradual but steady improvement in legibility of reproduced copies.

When DDC converted from 35mm roll film to the COSATI 20X microfiche format in August 1965, the state of the art was such that much of the available equipment was either prototype or converted from roll film operations. DDC built some equipment itself, and retrained personnel in new techniques and procedures.

To a lesser extent, there were similar problems when microfiche operations began converting from 20X to the new NMA 24X microfiche format. DDC completed this transition in the Spring of 1972, and by now most of the problems have been resolved. At this time, DDC, the Department of Commerce, ERIC, and NASA are all producing the 24X microfiche. Some organizations, including the Atomic Energy Commission, have not yet converted to the new format.

For several years, agencies have been accentuating quality control in their microfiche production lines, and quality control units comprised of skilled technical personnel have been established. Inasmuch as the original master microfiche is the key to the quality of subsequent film or paper reproductions, quality control personnel inspect each master. Copies not meeting quality standards are rejected, and the documents are reshot by the microcamera unit. When the original document quality is poor, special photographic techniques are employed to obtain maximum quality in the microfiche.

Although DDC personnel and production schedule limitations do not allow for individual quality inspection of all duplicates reproduced, systematic spot checks are made. All microfiche produced in DDC are inspected for density, line quality, and adherence to the established format. If the general quality

indicates a deterioration, a re-evaluation is made of all production steps in the pipeline. Similar inspection programs are followed by other agencies.

The DDC program to improve microfiche quality production also includes dispatching quality control personnel into the field to visit customer organizations to discuss the problems pertaining to the quality of products, as well as to learn about the techniques of other operations. The constant improvement of products has a high priority in DDC.

6. MICROFICHE STANDARDS

When microfiche first came into use in the U.S., an image size comparable to that provided by 16mm roll film was used extensively by the technical document producing services. This later became the 60-frame, 20X COSATI standard.²⁷ Recently, most of the document producing services have converted to the 98-frame, 24X NMA (National Microfilm Association)²⁸ size with an attendant gain in the number of pages displayed.

International standardization also has moved forward by adoption of the 105 X 148mm size as a base. However, both the 60- and 98-frame formats are permitted, together with variable division formats used extensively in France, Belgium and the Netherlands.²⁹ In these, the actual number of frames is varied by geometric ratio of 2, with images of either 2, 4, 8, 16, 32 or 64 on each fiche. These formats are produced by special step-and-repeat cameras.

Thirty-five millimeter roll film is widely used in the filming of uncontrolled research materials and micropublishing efforts. However, there is no reason why comparable images should not be placed on standard 105 X 148mm microfiche sheets to facilitate their use in library and research applications. William R. Hawken made such a proposal in his paper, "Microform Standardization: The Problem of Research Materials and a Proposed Solution."³⁰ He considered the impact of the basic National Bureau of Standards reduction ratio study and recommended a 32-frame format for research material applications, with standardized images on 35mm roll film and microfiche. This would afford compatibility with other uses of 35mm film such as slides and film strips produced by commercial sources and with hand cameras.

In addition to the 98-frame, 24X format now used by technical report documentation centers, a 270-frame, 48X Computer Output Microfiche (COM) format has been adopted by the U.S. Department of Defense for its extensive MINI-CATS (Miniaturization of Federal Catalog System Publications) program. This is a direct outgrowth of the 42X format widely used in COM programs.³¹

International adoption of the 105 X 148mm fiche size as the basic carrier, together with standard pagination, represents progress which will lead to lower equipment and supply costs. Further refinements are needed, however. Should Hawken's 12X (actually 12.7X to fit the 105 X 148mm size standard) proposal be actively considered, four basic reductions to fit the standard fiche carrier could gain popular acceptance:

Low	12X	(32 frames) for newspapers, research and uncontrolled materials (matching 35mm roll film strip size)
Medium	24X	(98 frames) for technical reports, business letters and similar letter size forms
High	48X	(270 frames) for computer-output-microfiche - (14 X 11" pages)
Ultra	96X	(1680 frames) for special book publishing efforts

Up to this point, ultrafiche programs have not been considered in this short review because they are generally not suitable for demand reproduction and distribution. Nevertheless, the standard 105 X 148mm fiche carrier can be used and, conceivably, the same reading machines by changing the optics. Hence, a report for the small user would not be complete without their mention.

Currently, a number of publishers use the higher reduction ratios; one uses a nonstandard 3 X 5" fiche size and 90X reduction, while another uses the standard 105 X 148mm fiche size with a 150X reduction, providing as many as 3200 images per fiche.³²

Advocates of higher and higher reductions with greater and greater compaction usually point to improved technology, films and equipment, often without realizing that J. B. Dancer made photographic reductions of 160X and read the results through his microscope back in 1839—the year that practical photography was first announced to the world.³³

The bulk of the micrographic literature simply describes what material and equipment are available without giving careful consideration to theoretical or optimum aspects. It would appear that micrographics is thus very much an art rather than a science, and that much is yet to be done.

In the U.S., the focal point of micrographic standardization in industry is in the National Microfilm Association, which regularly presents steps taken in the development of standards through its Journal of Micrographics. Industry standards are then submitted to ANSI—The American National Standards Institute—for consideration as National Standards. Some of the more pertinent recent articles include:

- Don M. Avedon. "The What, How, Why and the Law Regarding Standardization," Journal of Micrographics, 6:5 (May/June 1973) pp. 211-212
- _____. "International Organization for Standardization," Journal of Micrographics, 5:6 (July 1972) pp. 311-313
- _____. "1972 ISO Report," Journal of Micrographics, 6:3 (Jan 1973) pp. 141-143

George B. Bernstein. "Why 24X/48X?" Journal of Micrographics, 5:6 (July 1972)
pp. 295-300

Standardization, more often than not, proceeds on an after-the-fact basis. This evolutionary process often results in economic hardship when sizes, systems and processes are bypassed in the establishment of standards. Nevertheless, much has been done in recent years to overcome the confusion resulting from different microfiche formats. These moves toward effective standardization will reduce equipment costs and accelerate the interchange of information. There is still much to be done and there is a need for vigorous leadership and vision.

7. READING EQUIPMENT

This is a topic that is well covered in the literature. However, since it is such an important element in the use of microfiche by the small user it must be considered.

Microfiche as a tool for distribution of technical report material began in the U.S. with the introduction of the 5 X 8" size by the National Aeronautics and Space Administration (NASA) in 1961. Early reading machines for these were adaptations of roll film readers. The 5 X 8" trend did not last long, so that by the time the Defense Documentation Center adopted its microfiche program in 1965, the 4 X 6" (105 X 148mm) COSATI compromise had already been achieved.

Although, a few portable and desk-top microfiche readers were available, industry continued on an unguided course. Then, at an April 1968 users conference in Waltham, Mass., Dr. Harold Wooster set forth his proposal³⁴ for a "cuddly microfiche reader." It was to be book-size--a personal portable reader, "built to retail at no more than \$100." It was to be "self-contained," with battery operation (and with 12 and 110 volt alternatives). It was to be no greater in size than 8 X 11" and thin enough to fit into a "stuffed attache case." A page size of 5 X 7" was considered sufficient since "this is the size of a DDC report printed two pages on one and must be satisfactory or they wouldn't use it." It was to be readable under ambient light conditions. Dr. Wooster predicted that if these conditions were met they "should overcome the last obstacle to the use of microfiche."

Dr. Wooster's "modest" proposal was taken seriously. Today, when the cost of acceptable 35mm roll film reading machines has soared to \$1000 to \$2500,³⁵ several personal microfiche readers are marketed for "less than" \$100 per unit, and it is anticipated that the cost of personal readers will drop to \$50 or less.³⁶ Then, as the use of microfiche becomes truly universal and a personal microfiche reader as "necessary as a person's eyeglasses," one should be able to buy usable readers at the corner drug store for \$5.00 or less.³⁷ Even today, some firms offer a "free" reader with a minimal order or fiche subscription.³⁸ It is anticipated that this practice will grow.

Unlike office readers, the personal reader can be taken anywhere and, when not in use, can be stored in a drawer or a briefcase. These compact "book-type" readers represent a breakthrough in the micro-graphics art. Some have appeared on the market within the past year, with the oldest--the DASA PMR/50, developed under contract with the U.S. Office of Education, Department of Health, Education and Welfare--having been in production for only three years. While these readers are larger than Dr. Wooster's ideal, they represent distinct progress and are forerunners of things to come.

Rutgers University, Graduate School of Library Service, in a monograph, "Reading Devices for Microimages,"³⁹ noted that "the basic assumptions upon which the whole micro-form art is based have never been stated clearly and those that have been hinted at have not been supported by objective data."

After describing several reading devices, the monograph acknowledged the existence of others and concluded that "truly this summary shows that of making many micro-image reading gadgets there is no end."

With regard to costs the Rutgers monograph stated:

For over twenty years the literature has included unsophisticated discussion of this topic in meaningless language. The literature has numbers of statements about the need for an "inexpensive" reading machine, none of which defines the term "inexpensive," or the range of materials to be covered at any given cost. Also the literature repeatedly makes the assumption that cost of the machine is a major deterrent to more widespread use of micro-form readers, but no evidence is given to support that.

Fortunately, significant changes have been made during the last few years. Programs have been initiated by users organizations to test and evaluate micro-image readers and reader-printers to develop performance standards and purchasing guidelines and to promote improvements in existing equipment.

Foremost among these programs has been that of the American Library Association (ALA) and its Library Technology Program (LTP). Guidelines for selecting microform readers and reader-printers have been established. Surveys of available equipment have been made, and an active testing and evaluation program has been undertaken. Since 1965 equipment tests and evaluations have been made on approximately fifty items of microform equipment. Carefully prepared Library Technology Reports⁴⁰ have been prepared on these and distributed to LTP subscribers. It is of special interest to note that, of the items tested, considerably more than half have been microfiche reading devices.

In Great Britain, a similar program has been undertaken by the National Reprographic Centre for Documentation (NRCd). Standards have been established and a number of thorough and objective test reports issued on items of microform equipment. In addition, NRCd and LTP have established an exchange program whereby 'evaluations of microform equipment published by either of the organizations may be published by the other organization...thus avoiding duplication of effort and expenditures.'⁴¹ In line with this, several NRCd evaluations of American-made equipment appear in ALA's Library Technology Reports. This is a splendid example of international cooperation.

Another program of special interest was recently completed and reported by the National Archives and Records Service of the U.S. General Services Administration (GSA) in a paper released under the title, User Evaluations of Microfilm Readers for Archival and Manuscript Material. This is particularly significant because an earlier GSA publication avoided testing aspects and user evaluation considerations. This was a Records Management Handbook, Microform Retrieval Equipment Guide, published by GSA in 1970. The stated purpose was to:

Provide the prospective user or purchaser of microform retrieval equipment a basis for comparing available equipment against his requirements. It is not an equipment catalog nor is it an attempt to evaluate any individual manufacturer's equipment.

The foregoing guide is representative of many others produced by fostering government agencies, publishers and industry, often to meet the needs of their clientele. Among them are:

Hubbard W. Ballou, ed. Guide to Microreproduction Equipment, National Microfilm Association (NMA). Now in its fifth edition (1971), supplements are issued for years between editions. (1972 supplement is available and 1973 supplement in process.) This guide is limited to equipment manufactured or distributed in the United States. It is the basic microform reference tool.

Jack Rubin, ed. International Directory of Micrographic Equipment, International Micrographics Congress (IMC) 1967. This guide performs the same function as the NMA guide listed above, but shows microform equipment made outside the United States (with minor exceptions, such as electrical input requirements). The initial issue listed 243 items. The intention was to publish a yearly supplement, but none have yet appeared.

A Guide to Microfilm Readers and Reader-Printers, G. G. Baker & Associates, Guilford, England. Now in its second edition (1973), the guide is a complete updated and enlarged edition of that sold in 1972. It lists important changes which occurred during the past year and provides an excellent analysis of microforms used in Europe. It is well illustrated with line drawings showing the different equipments.

Microfilm Publishing Co. 1972 Microfilm Source Book (with a 1973 edition in process). This publication is intended to be a "single-source fact book that gives the sources of supply for every important service and piece of equipment related to microfilm." While it falls short of such a goal, it is a useful tool with much hard-to-find information. It includes a glossary of microfilm terms taken from the NMA's Industry Standard Glossary of Micrographics.

Ronald F. Gordon. Microfiche Viewing Equipment (AD-701 600, March 1970, and AD-734 400, December 1971). These directories were published in an effort to assist microfiche users since the Defense Documentation Center (DDC), a major producer of microfiche, had had continual requests for such information. While initially intended for Department of Defense (DoD) users, the directories have become very popular and are found in many libraries throughout the United States and Europe. The March 1970 edition listed 47 readers and reader-printers and provided an interesting introduction to microfiche usage. The December 1971 issue expanded the definition of microfiche and introduced the change from the 60-frame COSATI format at a reduction ratio of 20:1 to the 98-frame NMA format at 24:1. It also introduced Computer-Output-Microfiche and updated the reader and reader-printer compendium. (Companion directories for 16mm roll microfilm viewing equipment are also published by DDC in microfiche and hard-copy editions as are bibliographies on microfiche, microfilm and related equipment.)

Test reports on most of the new compact readers are not yet available. It is hoped that the American Library Association, through its LTP program, the British NRCd (National Reprographic Centre for Documentation) and others will soon come forward with careful evaluations to assist the small user in making his personal selection.

8. CONCLUSIONS

Microfiche are particularly well suited to the reproduction, dissemination, storage and retrieval of documents or records, particularly those of 20-98 pages. Since fiche are flat microforms they are easily retrieved and can be quickly duplicated for mailing or reference.

One of the major advantages of the microfiche is a possible savings of 70 percent or more in acquisition costs when a document is available in both microfiche and paper form. Another advantage is the elimination of document storage problems, since low-cost copies of microfiche can be produced at any point on demand. In many situations, the most significant advantage is the savings in time and costs for packaging, shipping, storing, and retrieving documents. The equipment for small users for duplicating microfiche copies is quite inexpensive when compared to the cost of roll film machines. Microfiche readers and reader-printers are also considerably less expensive. The economies achieved are primarily due to simple designs, containing few moving parts or motors.

For microfiche to serve as a satisfactory substitute for paper copy, it must be as legible and as easy to use as its paper counterpart. Successful utilization depends upon such factors as the condition of the original documents, the film, the camera, the camera operator's work, the quality of film processing and the effectiveness of the viewing equipment. A weakness in any of these areas may cause a fiche system to fail.

Vast microform collections of reports, drawings and photographs are available. The small user thus has a rich resource that offers convenience and economy. With a little training, quality microforms and no-fuss, portable reading devices, "a microfiche system for the small user" becomes a living reality. However, in planning any microfiche system for that small user we must be aware that his system is properly served only when it is recognized as being part of the total microfiche universe.

9. REFERENCES

- 1) AD-722 463. Wooster, Harold. "Group Discussion: Microfiche - Necessary Evil or Evil Necessity," Proceedings of the Fifth Scientific and Technical Information Seminar. Held at: Southern Connecticut State College, New Haven, Connecticut, 9 April 1970, p. 86.
- 2) Wilber, Alan W. "Microfiche Systems for the Small User," Journal of Micrographics, 5:3 (January 1972), p. 131.
- 3) AD-710 000. Wicker, Roger, and others. Microfiche Storage and Retrieval Systems Study: Final Report. Falls Church, Va.: Systems Development Corporation, August 1970, p. 1-1.
- 4) Van Auken, John and Van Auken, Richard. "Small Office Microfilm (SOM) Products: A Status Report," Journal of Micrographics, 5:5 (September 1971), p. 5.
- 5) MS-100-1971. NMA Standard Glossary of Micrographics. Silver Spring, Md.: National Microfilm Association, 1971.
- 6) LTP Publication No. 11. Hawken, William R. Copying Methods Manual. Chicago: American Library Association, 1966, pp. 341-360.
- 7) ASLIB Pamphlet No. 1. Holmstrom, John E. How to Take, Keep and Use Notes. London: ASLIB 1947, 28 pp.
- 8) AGARD Advisory Report No. 27 (AD-711 258). Vessey, H. F. The Use of Microfiche for Scientific and Technical Reports. August 1970, p. 111.
- 9) Veit, Fritz. "Microforms, Microform Equipment and Microform Use in the Educational Environment," Library Trends, 19:4 (April 1971), pp. 447-466.
- 10) Stahl, Norbert. "Problems and Opportunities with Microfilm," Journal of Micrographics, 3:2 (Winter 1969-70), pp. 66-67.
- 11) Lewis, Ralph W. "User's Reaction to Microfiche--A Preliminary Study," College & Research Libraries, 31:4 (July 1970), pp. 260-268.
- 12) Kottenstette, James P. "Student Reading Characteristics: Comparing Skill-Levels Demonstrated on Hardcopy and Microform Presentations." Proceedings of the American Society for Information Science, Vol. 6. Cooperating Information Societies 32nd Annual Meeting, San Francisco, California, October, 1969. Westport, Connecticut and London: Greenwood, 1969, pp. 345-351.
- 13) de Lavette, F. P. Renardel. "Miniaturising of Information," Microfiche Foundation Newsletter, No. 23 (October 1971), pp. 13-16.
- 14) "A Study of the Results Obtained in the Experiment Conducted by Chris Meynet for Bertrand Goldberg Associates and Evelyn N. Wood for Reading Dynamics to Determine the Effect of the Use of Microfilm on Reading Rate and Comprehension." Unpublished Report, Evelyn Wood Reading Dynamics, Salt Lake City, 1967, p. 10.
- 15) AD-695 049. Wooster, Harold. Microfiche 1969 - A User Study. Arlington, Va.: Air Force Office of Scientific Research, July 1969.
- 16) Campbell, B. W. "A Successful Microfiche Program," Special Libraries, 62:3 (March 1971), pp. 136-142.
- 17) Sawyer, Ted. "Hardcopy from Microfilm," Business Graphics, 7:3 (March 1973), pp. 14, 16.
- 18) Stevens, Rolland E. "The Microform Revolution," Library Trends 19:3 (January 1971), p. 380.
- 19) Hawken, William R. "Microform Standardization: The Problem of Research Materials and a Proposed Solution," National Microfilm Journal, 2:1 (Fall 1968), p. 26.
- 20) Van Auken, pp. 5-11.
- 21) Microform Review, 2:2 (April 1973), pp. 119-120.
- 22) Microinfo, 4:3 (March 1973), p. 1.
- 23) Inter Documentation Company AG, Microform Review, 2:2 (April 1973), p. 111.

- 24) Microfiche Foundation Newsletter, No. 23 (October 1971), p. 22.
- 25) PB-180 600. Guidelines to Format Standards for Scientific and Technical Reports Prepared by or for the Federal Government. Washington, D.C.: Committee on Scientific and Technical Information, December, 1968.
- 26) "STO-847A. Military Standard Format Requirements for Scientific and Technical Reports Prepared by or for the Department of Defense. Washington, D.C.: Department of Defense (DDC-T), 31 January 1973.
- 27) PB-167 630. Federal Microfiche Standards, 3rd ed. Washington, D.C.: Committee on Scientific and Technical Information, April 1968.
- 28) Bernstein, George B. "Why 24X/48X?" Journal of Micrographics, 5:6 (July/August 1972), p. 296.
- 29) Avedon, Don M. "International Organization for Standardization," Journal of Micrographics, 5:6 (July/August 1972), p. 313.
- 30) Hawken, pp. 20-27.
- 31) Bernstein, pp. 299-300.
- 32) Veit, p. 451.
- 33) Luther, Frederic. Microfilm: A History, 1839-1900. Indianapolis: The Frederic Luther Co., 1955, p. 16.
- 34) AD-699 204. Towards a Uniform Federal Report Numbering System and a Cuddly Microfiche Reader—Two Modest Proposals. Arlington, Va.: Air Force Office of Scientific Research, May 1968, pp. 12-14.
- 35) User Evaluation of Microfilm Readers for Archival and Manuscript Materials. National Archives and Records Service, General Services Administration, 1973, pp. 5ff.
- 36) Carpenter, J. W. "The Personal Microfiche Reader," The Office, (Visidyne Reprint), p. 1.
- 37) "The Five-Buck Reader May be Closer than You Think," Graphic Communications Weekly, 6:13 (27 March 1973), p. 2.
- 38) Microform Review, 2:2 (April 1973), p. 111.
- 39) Reading Devices for Micro-images. The State of the Library Art, Vol. 5, Pt. 2. Brunswick, N. J.: The Graduate School of Library Service, Rutgers - The State University, 1960, p. 5.
- 40) "Cumulative Contents, Section P1: Microforms & Equipment -- Readers, Library Technology Reports." Chicago: American Library Association, January 1965 - November 1972.
- 41) "The University Microfilms 1414 Reader." Library Technology Reports. Chicago: American Library Association, January 1971, p. 1. (States evaluation exchange agreement between LTP and NRCd.)

10. ACKNOWLEDGEMENT

I wish to express my gratitude to Messrs. George F. Tate and Charles E. Waterman and Mrs. Betty K. Grigsby for their assistance in preparing this paper.

APPENDIX

Information about microfiche and microfiche equipment is almost inexhaustible. To assist the user in staying abreast of this fast-moving field, following is a list of some of the services that provide information on a current basis.

A List of Periodicals and Newsletters for the Micrographics Industry (MR3-1972) and a List of Micrographics Standards (MRI-1972) are available from the National Microfilm Association (NMA). Current (1973) updates are in process. In addition, the NMA is establishing an Operations Resources Center to bring together all materials on microfilm and micrographics. Complete author/key word/subject indexing is planned, with the first release in about one year. In the meantime a complete index has been issued for all articles that have appeared in The Journal of Micrographics and its predecessor, The NMA Journal, from its beginning in the Fall of 1967 to March 1972. It is available from the National Microfilm Association. An updated 1973 cumulation of the index is planned for Fall 1973.

Much information on micrographics appears in library and information science periodicals. Library Literature (New York: H. W. Wilson) indexes over 200 of these, including major foreign language periodicals. A selected list of recent accessions of ERIC/CLIS (Educational Resources Information Center/Clearinghouse on Library and Information Science) and a check list of monographs cited for the first time are included in the bimonthly issues. (While MICRODOC, the Journal of the Microfilm Association of Great Britain, is indexed by Library Literature, The Journal of Micrographics is not. Action has been initiated to remedy this condition.)

Abstracts of micrographics articles frequently appear in Information Science Abstracts (Philadelphia: Documentation Abstracts) and in Library and Information Science Abstracts (London: Library Association). Micrographics articles announced by U.S. Government document-producing services and by AGARD are usually abstracted and indexed in Government Reports Announcements (GRA), published by the U.S. Department of Commerce, National Technical Information Service (NTIS). In addition, computer search techniques can be used with the U.S. Government report materials.

A particularly valuable review of micrographic progress is published each year by Library Resources & Technical Services (LRTS), Chicago: American Library Association. The Spring 1972 issue (16:2), included "Developments in Copying, Micrographics, and Graphic Communications, 1971," by Dr. Francis F. Spreitzer, University of Southern California Library, Los Angeles, California, (pp. 135-154-106 references). A 1972 report is in process.

Microform Review (Weston, Connecticut), was established in 1972 as a means of announcing and evaluating new microform publications. It is performing a needed service since many publications do not appear in government reports announcement channels or normal library literature. Suppliers' catalogs such as Serials in Microform/1972 (University Microfilms) and Guide to Microforms in Print 1972-73 (National Cash Register Co.) are also helpful. The resources of the Library of Congress are of particular value. They illustrate the rapidity of microfilm growth. For example Newspapers on Microfilm, published in 1967, will be replaced in 1973 with two volumes with about double the entries - 32,600 U.S. and 8,700 foreign titles. (Microform Review, 2:2, p. 83)

Microinfo (U.K.) and Microfilm Newsletter (U.S.) exchange current awareness information in an attempt to "ensure for readers of both publications full coverage of international events in the changing world of micrographics" (Microinfo 4:1, January 1973, p. 3). Graphic Communications Weekly also provides micrographics news, particularly from the publication standpoint. Science Associates/International, Inc., Information, publishes news, information on sources and profiles.

A "unique and up-to-date" six page "Bibliography of Micrographics" appeared in The Journal of Micrographics, 6:3 (January/February 1973, pp. 113-118. For European readers the bibliography was reprinted in Microinfo for April and May 1973, (4: 485). It is referenced for basic information.